

Science Olympiad - Cobra Invitational - Division B

# Meteorology

February 3rd, 2017

Team name \_\_\_\_\_ Team # \_\_\_\_\_

## SCORING

Multiple Choice: \_\_\_\_\_ /25

Free Response: \_\_\_\_\_ /25

Tie-breaker #1: \_\_\_\_\_

Tie-breaker #2: \_\_\_\_\_

**TOTAL SCORE**

\_\_\_\_\_ /50

**RANK**

# \_\_\_\_\_

1. Which is the state of the atmosphere at a particular place and time?
  - a. Weather
  - b. Climate
  
2. The principal source of free oxygen in the atmosphere is \_\_\_\_\_.
  - a. Oxidation
  - b. Photosynthesis
  - c. Evaporation
  - d. Ocean offgassing
  
3. The minute liquid and solid particles that are suspended in the atmosphere are known as \_\_\_\_\_.
  - a. Minutia
  - b. Aerosols
  - c. Nuclei
  - d. B and C
  
4. Which of the following is NOT a source for aerosols?
  - a. Volcanic eruptions
  - b. Wind erosion of soil
  - c. Ocean spray
  - d. Evaporation from a lake
  
5. Photochemical smog is classified as a \_\_\_\_\_ air pollutant.
  - a. Primary
  - b. Secondary
  
6. The interaction of the solar wind with the Earth's magnetic field produces the \_\_\_\_\_.
  - a. Magnetosphere
  - b. Ionosphere
  - c. Thermosphere
  
7. Based on the average vertical temperature profile, the atmosphere is divided into four layers. Most weather is confined to the layer called the \_\_\_\_\_.
  - a. Troposphere
  - b. Stratosphere
  - c. Mesosphere
  - d. Thermosphere

8. Which of the following affect climate?
- Distance from the equator
  - Height above sea level
  - The amount of surrounding water
  - All of the above
9. Weather DOES NOT include which factor?
- Temperature
  - Wind speed
  - Amount of sunlight
  - All are factors of weather
10. The ultimate source of the energy that drives the atmosphere, produces weather, and is the principal control of climate is the \_\_\_\_\_.
- Earth's geothermal heat
  - Sun
  - Convection current
11. Because of the great differences in their surface temperatures, the sun radiates most intensely in the visible segment of the electromagnetic spectrum, whereas the much cooler Earth radiates most intensely in the \_\_\_\_\_ segment.
- Visible
  - Infrared
  - Ultraviolet
  - Radio
12. Assuming no atmospheric effects, the total amount of solar energy received at a particular location on Earth during one daylight period is determined by the length of daylight and \_\_\_\_\_.
- Solar altitude (angle of sunlight)
  - Varying intensity of the sun
  - Both A and B
13. The lower the albedo of a surface, the \_\_\_\_\_ the amount of radiation falling on that surface that is absorbed and converted to heat.
- Greater
  - Less

14. The most potent greenhouse gas is \_\_\_\_\_. (tie breaker #1)
- a. Carbon dioxide
  - b. Fluorinated gases
  - c. Water vapor
  - d. Ozone
15. Under otherwise clear sky conditions, the lower the amount of water vapor in the air, the \_\_\_\_\_ the overnight low temperature.
- a. Lower
  - b. Higher
  - c. The water vapor does not affect temperature
16. Air is a relatively \_\_\_\_\_ conductor of heat.
- a. Good
  - b. Poor
17. The transfer of heat from Earth's surface is greater over \_\_\_\_\_.
- a. Forests
  - b. Oceans
  - c. Dark mountains
  - d. Light desert
18. Of the following processes, which is the most important for transferring heat in the atmosphere?
- a. Conduction
  - b. Convection
  - c. Radiation
19. The Coriolis Effect causes \_\_\_\_\_.
- a. Global winds and surface currents to move in a straight line
  - b. Global winds and deep ocean currents to move in a curved path
  - c. Global winds and deep ocean currents to move in a straight line
  - d. Global winds and surface currents to move in a curved path
20. How do warm water currents affect the coastal areas along which they flow?
- a. They create greater rainfall along the coast
  - b. They create unusually cool climates for the latitude
  - c. They create unusually warm climates for the latitude
  - d. They make the coastal climate cooler than the inland climate

21. El Niño occurs when tropical ocean waters are warmer in which ocean?
- a. Atlantic
  - b. Indian
  - c. Pacific
  - d. Arctic
22. How does the greenhouse gas effect work?
- a. Greenhouse gases reflect the sun's energy, causing it to warm the Earth.
  - b. Greenhouse gases absorb the sun's energy, slowing or preventing heat from escaping into space.
  - c. Greenhouse gases directly warm oceans and cause dramatic weather.
  - d. Oceans absorb greenhouse gases, which cause the Earth's temperature to rise.
23. What is the biggest source of greenhouse gas emissions in the United States? (tie breaker #2)
- a. Farming, logging and manufacturing
  - b. Producing electricity
  - c. Heating and cooling buildings
  - d. Using transportation
24. Air pressure is \_\_\_\_\_ at the equator and \_\_\_\_\_ at the poles.
- a. Low; high
  - b. High; high
  - c. High; low
  - d. Low; low
25. Colder air sinks because it \_\_\_\_\_ than warmer air.
- a. holds more water
  - b. is more dense
  - c. is less bouyant
  - d. moves slower

**Stop using Scantron.**  
**Continue to free response section.**

**26-28. Label the following as either POSITIVE FEEDBACK or NEGATIVE FEEDBACK.**

26. If the atmosphere warms, the amount of water vapor in the atmosphere will increase (because the saturation vapor pressure goes up). Since water vapor is a greenhouse gas, the added water vapor will make the atmosphere warm even further.

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27. Higher amounts of the greenhouse gas  $\text{CO}_2$  means that the Earth's surface temperature will increase. These warmer temperatures can extend the growing season for plants, which increases the length of time they can draw  $\text{CO}_2$  from the atmosphere. This reduces the amount of atmospheric  $\text{CO}_2$ .

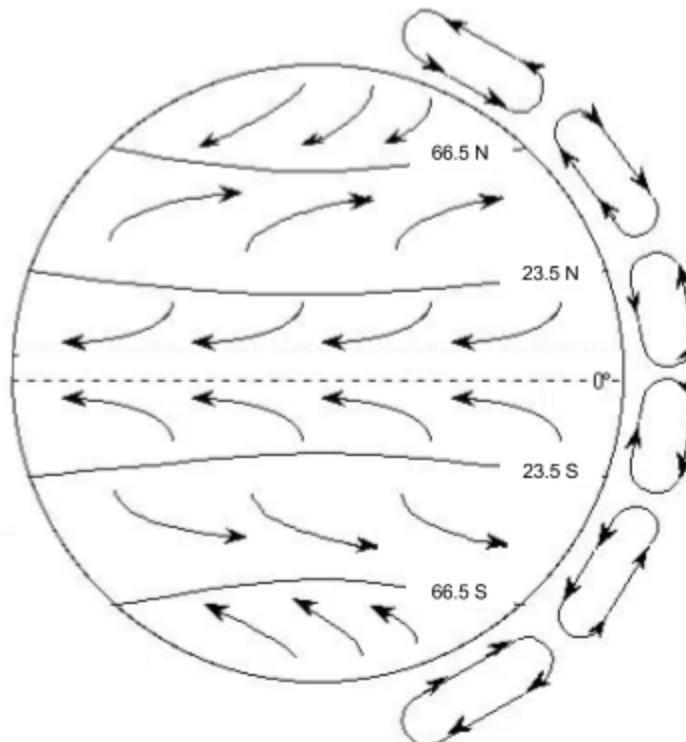
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28. When ice melts, land or liquid water takes its place. Both land and liquid water are less reflective than ice and absorb more solar radiation. This causes more warming, which in turn causes more melting.

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**29-37. Label the diagram below using ALL of the words from the word bank. Answer the questions that follow.**

Hadley Cell	Polar Cell	Polar Easterlies	Tropic of Capricorn
Ferrel Cell	Westerlies	Trade winds	Tropic of Cancer



38. At which latitude is the air pressure low? \_\_\_\_\_

39. At which latitude is the air pressure high? \_\_\_\_\_

40-43. Explain the movement of air in a Hadley cell. (3 pts)

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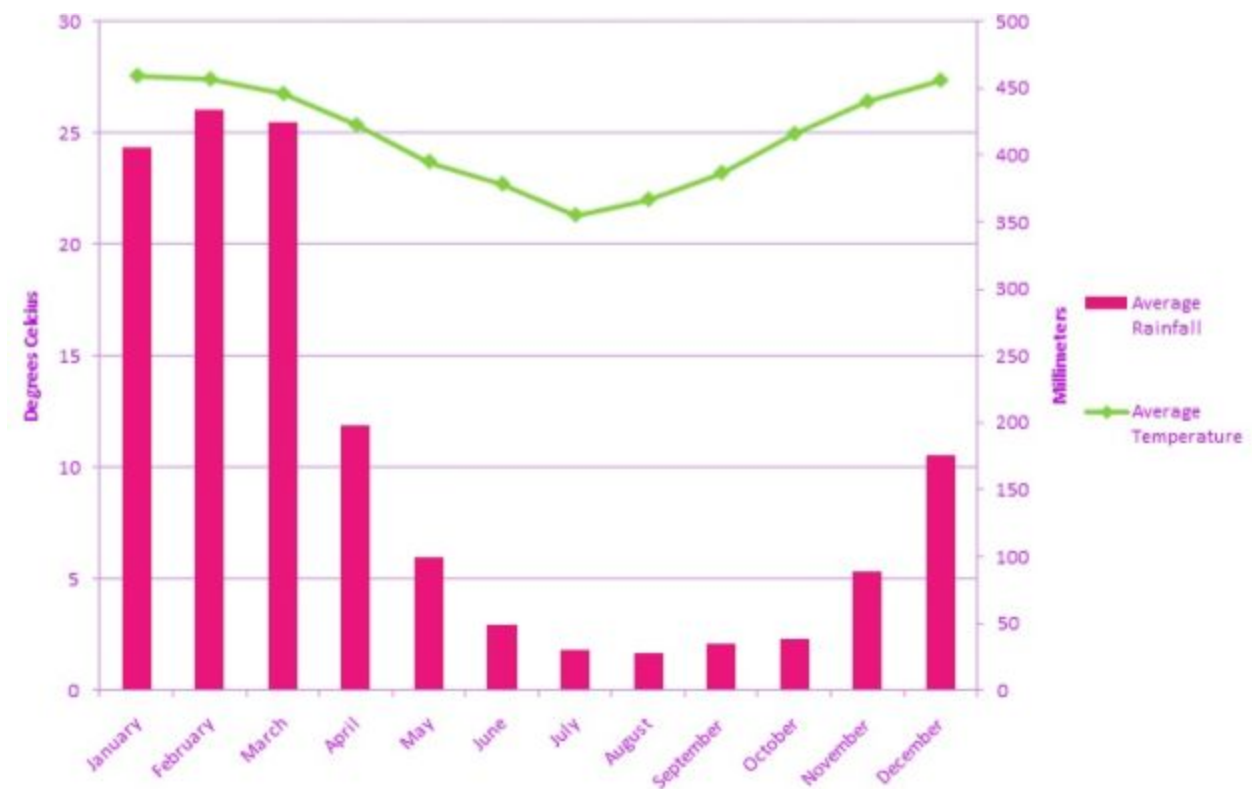
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**The (hypothetical) data below describes a newly discovered island. Use it and the climatograph to answer questions 44-50.**

Latitude: 19°S

Longitude: 148°E

Highest point: 1,198 ft



44. What is the average temperature on the island in July? \_\_\_\_\_

45. This island's climate is characterized by a rainy season and a dry season. In which months does the rainy season occur?

\_\_\_\_\_

46-47. Explain why our typical summer months (June, July, August) on this island are the coldest months of the year. (2 pts)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

48-50. Which climate zone would we find on this island? Justify your answer using the data and climatograph above. (3 pts)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_